Original Research Article

How often do we observe blood pressure values of 110/70 and 120/80 mmHg in clinical practice?

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Abstract

Background: Measuring blood pressure and detecting hypertension are significant in antenatal monitoring. Most clinicians read blood pressure (BP) only to the nearest 10 mmHg. It is consistently seen in BP records that end digit is rounded off to zero showing end-digit preference (EDP) or terminal digit preference (TDP). Here, we assessed the frequency of EDP/TDP and 110/70 and 120/80 mmHg among BP records.

Materials and methods: This was an observational study conducted in the outpatient department of Obstetrics and Gynecology. BP measurements were observed in 200 women. Fifty were healthy and non-pregnant while the remaining 150 were pregnant women, 50 from each trimester. Women between 20 and 30 years were included and those having any organic disease were excluded. Data was collected from10 am to 12 noon.

Results: We found an increased frequency of EDP of zero among Systolic Blood Pressure (n=142, 71%) and Diastolic Blood Pressure (n=126, 63%) records and 110/70 mmHg (19.5%) and 120/80 mmHg (23. 5%). The number of patients with110/70 mmHg increased from 1st to 3rd trimester (n=6 in 1st trimester, n=10 in the 2nd trimester and n=17 in 3rd trimester) whereas those with 120/80 mmHg decreased from 1st to 3rd trimester (n=15 in 1st trimester, n=11 in the 2nd trimester and n=5 in 3rd trimester).

Conclusion: We observed the higher frequency of terminal digit being zero, 110/70 and 120/80 mmHg in BP measurements. Health care professionals should be well-trained to avoid misinterpretation and misdiagnosis of hypertension, particularly among pregnant women.

Key words

End digit preference, Terminal digit preference, BP measurement, 110/70 mmHg, 120/70 mmHg, Pregnancy.

Introduction

Hypertensive disorders are the most common medical complication of pregnancy. Pre-eclampsia is the most dangerous of the hypertensive disorder and its detection is of prime importance. Pre-eclampsia is associated with proteinuria or relevant end-organ dysfunction requiring antihypertensive therapy to alleviate the increased cardiovascular risk [1, 2]. Accurate measurement of blood pressure is essential in pregnant women as 10% of them will be clinically hypertensive. Lack of training and poor auscultation technique is responsible for inaccurate BP measurement using mercury sphygmomanometer and aneroid devices. User error is less with automated devices but requires validation of accuracy as they tend to underestimate BP in pre-eclampsia. Systolic hypertension is a better predictor of adverse outcome (such as hemorrhagic stroke) than diastolic hypertension and to accurately detect hypotension in pregnancy is of paramount importance in the diagnosis of shock secondary to hemorrhage and sepsis [3]. Traditional blood pressure (BP) recording is subject to observer error. Preference for a certain number as the last number in the BP recording is called terminal digit preference (TDP)or end-digit preference (EDP) or single number preference, which is zero most of the times. This leads to inaccuracies in measurement with digit bias being an important source of error in BP measurement [4]. TDP in BP measurement has been reported in both clinical and research settings [5]. In this study, we attempted to observe TDP of zero during BP recording in pregnant and non-pregnant women attending OBG out-patient clinics.

Materials and methods

This observational study was conducted in the outpatient department of Obstetrics and Gynecology. BP measurements were observed in a total of 200 women of which 50 were healthy non-pregnant women while the remaining 150 were pregnant women, 50 from each trimester. Women between 20 and 30 years of age were included in the study. Women aged less than 20 years or more than 30 years and those having any organic disease were excluded. Following an explanation of the nature and purpose of the study, those subjects willing to participate in the study were included after obtaining written informed consent. Data acquisition was performed in the morning 10 am to 12 noon. A detailed assessment was done and a pretested structured proforma was used to record the relevant information from each case. The data was analyzed using descriptive statistics.

Results

We observed the BP measurements in 50 healthy non-pregnant women and 150 pregnant women (50 from each trimester). The mean age was 24.8±2.47 years. Frequency of BP recordings in all groups of subjects was as per **Table - 1**. The

BP recordings of end digit being zero observed in our study were 120, 110, 80 and 70 mmHg which showed an increased frequency in all the groups. (**Table – 1** to **Table - 2**) Measurements of 120/80 mmHg and 110/70 mmHg were observed for the frequency. (**Table - 3**) There was a preference of end digit zero of SBP in 142 women (71%) and DBP in 126 women (63%) out of the total 200 women.

Table - 1: Blood pressure recorded.

Blood pressure (mm Hg)	**Non-pregnant**		**1st trimester**		**2nd trimester**		**3rdTrimister**		**Total**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
104/70	0	0	0	0	0	0	1	2	1	1
106/76	1	2	0	0	0	0	1	2	2	1
108/68	0	0	0	0	0	0	1	2	1	1
108/72	0	0	0	0	0	0	1	2	1	1
110/68	0	0	0	0	0	0	1	2	1	1
110/70	6	12	6	12	10	20	17	34	39	20
110/72	0	0	0	0	1	2	1	2	2	1
110/74	0	0	0	0	2	4	0	0	2	1
110/76	1	2	1	2	0	0	1	2	3	2
110/78	1	2	0	0	2	4	0	0	3	2
110/80	0	0	1	2	0	0	0	0	1	1
112/70	0	0	0	0	0	0	3	6	3	2
114/68	0	0	0	0	0	0	1	2	1	1
114/72	1	2	1	2	0	0	0	0	2	1
114/80	0	0	0	0	0	0	1	2	1	1
116/68	0	0	0	0	0	0	1	2	1	1
116/70	0	0	0	0	3	6	2	4	5	3
116/74	0	0	0	0	2	4	0	0	2	1
116/76	0	0	0	0	2	4	0	0	2	1
116/80	3	6	3	6	0	0	1	2	7	4
118/70	0	0	0	0	1	2	2	4	3	2
118/76	0	0	0	0	3	6	1	2	4	2
118/78	1	2	1	2	0	0	0	0	2	1
118/80	3	6	4	8	3	6	1	2	11	6
120/70	1	2	1	2	1	2	1	2	4	2
120/72	0	0	0	0	1	2	0	0	1	1
120/74	0	0	0	0	0	0	1	2	1	1
120/76	5	10	6	12	7	14	3	6	21	11
120/78	3	6	2	4	1	2	0	0	6	3
120/80	16	32	15	30	11	22	5	10	47	24
120/82	3	6	4	8	0	0	0	0	7	4
120/84	2	4	2	4	0	0	1	2	5	3
122/78	0	0	0	0	0	0	1	2	1	1
122/80	0	0	0	0	0	0	1	2	1	1
124/76	1	2	1	2	0	0	0	0	2	1
124/80	1	2	1	2	0	0	0	0	2	1
126/72	1	2	1	2	0	0	0	0	2	1
Grand Total	50	100	50	100	50	100	50	**100**	**200**	**100**

Table – 2: End digit preference of zero in blood pressure recordings.

Blood Pressure (mm Hg)		Non-pregnant		1st trimester		2nd trimester		3rd trimester		Total	
		n	%	n	%	n	%	n	%	n	%
SBP	110	8	16	8	16	15	30	20	39	51	100
	120	30	33	30	33	21	23	11	11. 96	92	100
DBP	70	7	13	7	13	15	27	26	47. 27	55	100
	80	23	33	24	34	14	20	9	12. 86	70	100

Table - 3: Frequency of occurrence of 120/80 and 110/70 mmHg among BP recordings.

Blood Pressure (mm Hg)	Non-pregnant		1st trimester		2nd trimester		3rd trimester		Total	
	n	%	n	%	n	%	n	%	n	%
120/80	16	32	15	30	11	22	5	10	47	24
110/70	6	12	6	12	10	20	17	34	39	20

SBP of 120 mmHg was recorded in a total of 92 (46%) women. Among these, 30 (32. 61) were non-pregnant women and pregnant women of 1st trimester each, 21 (22. 83%) were in 2ndtrimester and 11 (11. 96%) in the 3rd trimester. SBP of 110 mmHg was recorded in a total 51 (25. 5%) women of which 8 (15. 69%)were non-pregnant women and women of 1st trimester each, 15 (29. 41%) were in 2ndtrimester and 20 (29. 22%) in the 3rd trimester.DBP of 80 mmHg (35%) was recorded in 70 women (35%) wherein 23 (32. 86%) were non-pregnant women, 24 (34. 29%) 1st trimester women, 14 (20%) 2nd trimester and 9 (12. 86%) 3rd trimester women.DBP of 70 mmHg was observed in a total of 55 (27. 5%) of which7 (12. 73%) were non-pregnant and 1st trimester, 14 (20%) 2nd trimester and 9 (12. 86%) 3rd trimester (**Table - 2**).

We also observed higher frequencies of 120/80 mmHg and 110/70 mmHg.120/80 mmHg was recorded in a total of47 (23. 5%) women - 16 (34. 04%) non-pregnant women, 15 (31. 91%) 1st trimester, 11 (23. 4%) 2nd trimester and 5 (10. 64%) 3rd trimester.110/70 mmHg was recorded in 39 (19. 5%) women - 6 (15. 38%) non-pregnant and 1st trimester women,10 (25. 64%) in 2nd trimester and17 (10. 64%) 3rd trimester (**Table - 3**).

Discussion

Accurate measurement of BP is essential to categorize individuals, to identify BP-related risk, and to guide management. The auscultation technique with a trained observer and mercury sphygmomanometer continues to be the method of choice for measurement, using the first and fifth phases of the Korotkoff sounds, including in pregnant women [6].

Elevated BP results in clinical manifestations only after target organ damage occurs. Therefore, accurate measurement is of paramount importance. Consistent underestimation and overestimation of even as low as 5 mmHg could result in misdiagnosis [7].

Traditional BP methodology is subject to observer error. Geoffrey Rose, et al. classified observer error into systematic error, TDP and observer prejudice. Systematic error leads to both Intra-observer and inter-observer error, caused by lack of concentration, poor hearing, etc., most important being inaccurately interpreting Korotkoff sounds, particularly for diastolic pressure. In TDP, the observer rounds off the pressure reading to a digit of her/his choice which majority of times is zero. This can adversely influence the decisions in the diagnosis and management of hypertension. Observer prejudice or bias is where the observer adjusts the pressure value according to his/her preconceived notion. Most often, the observer either over-reads or under-reads the BP value leading to misdiagnosis [2]. Generally, EDP of zero is observed at the extremes of BP. However, one study showed that EDP of zero was seen at

higher BP levels in patients with chronic diseases [8].

In our study, we observed the BP measurements of 150 pregnant women (50 from each trimester) and 50 healthy non-pregnant women (**Table - 1**). The frequency of occurrence of terminal digit being zero was recorded to be high. Such measurements were 120 mmHg, 110 mmHg, 80 mmHg and 70 mmHg. SBP with terminal digit zero was recorded in 142 patients (71%) whereas that of DBP in 126 (63%) women (**Table - 2**). This is in accordance with previous studies wherein 60-90% of recordings had TDP of zero being reported from clinics and hospitals, including specialist hypertension clinics [9]. Patients' gender, admission to a surgical department, admission heart rate, history of hypertension, and SBP and DBP values were risk factors for zero as the end-digit BP value [10].

Table - 2 showed end digit zero preference of blood pressure recordings. SBP of 120 mmHg was recorded in a total of 92 (46%) women of which 30 (32. 61%) were non-pregnant women and pregnant women of 1sttrimester each. We noticed a decrease in the number of women of 120 mmHg from 1st trimester- 30 (32. 61%) to 3rd trimester -11 (11. 96%). SBP of 110 mmHg recorded in a total 51 (25. 5%) women. 8 (15. 69%) were non-pregnant women and women of 1st trimester each. There was an increase in the number of women of 110 mmHg from 8 (15. 69%) in 1st trimester to 15 (29. 41%) in 2nd and 20 (29. 22%) in 3rd-trimester women.

DBP of 80 mmHg (35%) was recorded in 70 women (35%). 23 (32. 86%) were non-pregnant women. Among pregnant women, there was a gradual decrease in the frequency from 24 (34. 29%) in 1st trimester to14 (20%) in 2nd and 9 (12. 86%) in the 3rd trimester. DBP of 70 mmHg was recorded in a total of 55 (27. 5%) women. 7 each (12. 73%) in non-pregnant and 1st-trimester group. The number decreased from 14 (20%) in 2nd trimester to 9 (12. 86%) in the 3rd trimester.

We observed the higher frequency of 120/80 mmHg and 110/70 mmHg among the recordings. Recording of 120/80 mmHg was observed in a total of 47 (23. 5%) women of which 16 (34. 04%) were non-pregnant women, 15 (31. 91%) were in 1st trimester, 11 (23. 4%) in 2nd trimester and 5 (10. 64%) in 3rd trimester. We noticed a declining trend of recording 120/80 mmHg over the three trimesters. 110/70 mmHg was noticed in a total of 39 (19. 5%) women - 6 (15. 38%) each was from non-pregnant and 1st-trimester group, 10 (25. 64%) in the 2nd trimester and 17 (10. 64%) in the 3rd trimester. We noticed an increasing trend in the frequency of 120/80 mmHg over the three trimesters (**Table - 3**).

The change in frequency of occurrence of the recording could be because of the alertness among the healthcare professionals (HCPs) while recording BP as the patients were approaching third trimester and labour.

Physicians and Obstetricians are not particularly known for their skills in measuring accurate BP. Most read BP only to the nearest 5 or 10 mm Hg. In one particular study, there was a huge degree of TDP with more than 65% of all readings ending in zero (0), and only 4% in a two (2) [11].

The observer requires repeated and meticulous training to measure BP accurately. Several studies have studied the factors responsible for bias while BP recording. These include inappropriately sized cuff, incorrect arm position, lack of rest period before measurement, faster deflation of the cuff, not measuring in both arms, failure to palpate maximal systolic pressure before auscultation, incorrect interpretation of Korotkoff sounds and TDP, recent ingestion of alcohol and acute exposure to cold [11-13]. Observers may be influenced by the knowledge of previous BP values during serial readings (expectation bias). Older physicians and nurses who use a stethoscope to measure BP should have their hearing tested regularly. Rapid cuff deflation underestimates SBP resulting in misdiagnosis and under-treatment of patients

with hypertension which compromise pregnancy outcomes [13].

In pregnant women, it is advisable to record BP in sitting or left a lateral position with arm resting on a pillow at heart level. Lying supine makes the gravid uterus compress inferior vena cava resulting in a decrease in venous return, cardiac output, BP, and syncope. The positioning of the woman's arm is very important. Dropping arm by side may increase systolic BP by 10 mmHg [7]. Supporting the arm at mid-sternum level allows for a more accurate BP measurement as it lies at the level of the right atrium. Sizes of the cuff, inflation, and deflation rate are important too. The stethoscope should not be placed under the cuff because this increases the pressure over the brachial artery resulting in a false low DBP measurement. Underestimation of SBP and overestimation of DBP can occur if deflation rate is faster [14]. According to a study, nearly 8% of mercury sphygmomanometers were out of calibration by at least 4 mmHg and 5% of physicians relied solely on mercury devices. Almost 17.9% of surveyed devices gave calibration errors exceeding the +/-3 mmHg threshold. Regular calibration of sphygmomanometers is essential to ensure accurate measurement of BP [15]. In infants; the ultrasound technique is best. During pregnancy and after exercise, the diastolic pressure may be hard to measure using the conventional auscultation method. In obese subjects, it is important to use a cuff of the correct size [16].

The use of mercury is declining, and hence, alternatives like aneroid and hybrid devices are being tried. Aneroid devices are less prone to observer error but require frequent calibration [17]. If an abnormal BP reading is found using the automated BP machine; then BP should be recorded manually again [14]. The high prevalence of EDP for zero urges for the training, retraining and certification of healthcare professionals in BP measurement. Institution should regularly monitor by a good feedback system on EDP to minimize this observer error [18].

Our study has a few limitations which include small sample size, the inclusion of subjects from OBG department alone. We also did not observe the difference in BP recording among different healthcare professionals.

Conclusion

The percentage of appearance of 110/70 and 120/80 mmHg blood pressure recordings was 20 and 24 respectively. This observation followed an increasing trend from 1st to 3rd trimester in110/70 mmHg blood pressure recordings whereas 120/80 decreased from 1st to 3rd trimester. Additionally, we believe that the higher levels of terminal digit preference are due to observer bias which can be corrected by improved training in accurate BP measurement and technique, regular monitoring, and feedback to minimize such errors. Appropriate training should be given to health care professionals to avoid misinterpretation of BP and misdiagnosis of hypertension, particularly among pregnant women.

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